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TRIAL USE OF FOAM SPRAY-DRIED WHOLE MILK IN SELECTED TYPES OF INSTITUTIONS

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PREFACE

Milk is used in a variety of products. The largest single amount is consumed as fluid whole milk, although there has been a downward trend in the per capita consumption of whole milk for many years. The dairy industry has been seeking new whole milk products that might reverse the trend. The study reported here--part of a broad program of research being conducted by the Department of Agriculture to help farmers sell their products--evaluated the market possibilities for foam spray-dried whole milk, a new product developed in the Department of Agriculture.

The Dairy Products Laboratory, Eastern Utilization Research and Development Division, Agricultural Research Service developed the process for foam spray-dried whole milk. The study was conducted under the general supervision of Marshall E. Miller, Chief, Market Development and Performance Branch, and Philip B. Dwoskin, Program Coordinator for Utilization Economics, Marketing Economics Division, Economic Research Service.

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SUMMARY

Foam spray-dried whole milk, an improved dried milk developed in the Department of Agriculture, was rated acceptable for beverage use by food managers of eight nonprofit or charitable institutions in the Washington, D.C., area. The eight institutions were selected to use the product on a trial basis. Altogether, about 600 people were served the reconstituted milk.

In general, the results of the product tests were encouraging. Most of the residents of the institutions did not notice or react unfavorably to having their fresh whole milk replaced with the reconstituted product.

Managers reported that a foam appeared on the surface of the milk when the power was reconstituted. On the assumption that the residents would object to it, the foam was skimmed off. However, all managers seemed satisfied with the dispersibility of the powder.

The results of the product tests indicated that institutions that presently purchase half-gallon cartons of milk could switch to the reconstituted foam spray-dried milk without making any major changes in food service procedures. Whether milk is purchased in half-gallon cartons or reconstituted, it must be poured into glasses and transferred to the dining area by kitchen personnel. However, health ordinances might present some problems in the use of dry whole milk for beverage purposes. Several managers thought that for sanitary reasons special equipment to reconstitute and dispense the milk might be required.

Most of the food managers said they would consider using dry whole milk if it were commercially available. Their decision whether to use the product would depend primarily on two factors: the cost and the approval of health authorities. All of the managers thought the dry whole milk would be less expensive than fresh milk. A saving of around 5 cents per quart was the amount most frequently suggested as sufficient to justify using the dried milk.

Foam spray-dried milk will probably have a price advantage over fresh milk, although exact selling prices of the new product are not known. The cost of manufacturing dry whole milk by the foam spray process appears to be very similar to the cost of conventional methods.

Several of the institutions limited the consumption of fresh milk because of its relatively high cost. At the time of the study, the most economical method of purchasing milk, according to the managers, was in half-gallon cartons. Three of the managers indicated that their institutions would probably increase their consumption of milk if a less expensive product were available.

TRIAL USE OF FOAM SPRAY-DRIED WHOLE MILK IN SELECTED TYPES OF INSTITUTIONS

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INTRODUCTION

Milk is marketed as fluid whole milk or in a variety of processed dairy products, each containing varying amounts of milk fat solids and nonfat solids. Since the milk fat in 100 pounds of milk is worth 2 to 3 times as much as the nonfat solids, the pattern of consumption is quite important. Until consumers become more familiar with the nutritive values of the nonfat components of milk and reflect this back to the market in the form of demand and price, the prosperity of the dairy industry will be closely related to the demand for dairy products containing milk fat.

Whereas milk fat and nonfat solids are produced in a rather fixed ratio, consumer demand for these components tends to change over time. In recent years, consumption of whole milk products and butter has declined. During the 15 years from 1950 to 1965, per person consumption of fluid whole milk and cream declined from 309 pounds of product to 278 pounds and evaporated milk consumption declined from 18.1 pounds to 8.5 pounds. This downward trend was accompanied by an increase in the consumption of several low-fat dairy products--including low-fat fluid milk, and low-fat frozen desserts such as ice milk and sherbet.

When milk is marketed as whole milk, the dairy industry is assured of a market for both milk fat solids and nonfat solids. As the consumption of whole milk declines, the demand for milk fat solids may fall below that for nonfat solids. One method of avoiding this problem is to develop new products made with whole milk.

Today, the only satisfactory whole milk beverage is fresh milk. The availability of only one product has undoubtedly restricted the opportunity for market expansion. Both the Government and the dairy industry have been seeking new whole milk products which would increase consumption of milk as a beverage. One such product is dry whole milk. The availability of a beverage-quality dry whole milk would give the dairy industry more flexibility in meeting consumer demand for beverage milk, and perhaps help to slow the downward trend in the consumption of milk in all products.

The effect of the product on the income of dairy producers would depend to a great extent on the amount of total sales of the dry whole milk which represents additional consumption of milk as opposed to substitution of dry whole milk for fluid whole milk. Different groups of producers would be affected differently, and the long-run effects might differ from the short-run effects. Beverage-quality dry whole milk could probably be shipped from a low-cost producing area, such as the Midwest, to markets where milk is more expensive. In the short run, this might have an adverse effect on the income of dairy producers in the high cost area. Reduction of the number of production units in the high-cost area and the shift of resources to more profitable enterprises in the high-cost area would probably minimize this problem in the long run.

DRY WHOLE MILK--A BRIEF HISTORY

Dry whole milk has been an item of commerce since 1906, but it has never attained a significant position in the dairy industry's product mix. U.S. production of dry whole milk reached an all-time high of around 200 million pounds in the mid-1940's as a result of Government requirements during World War II. Since that time, production has slowly declined and in recent years has averaged around 90 million pounds. Annual production of dry whole milk has a wholesale value of around $32 million. 1/

In 1965, there were 52 plants producing dry whole milk in the United States. Although dry whole milk is produced in 16 States, over 70 percent of it is produced by plants located in Minnesota, Wisconsin, New York, Michigan, and Illinois.

Dry whole milk is both exported and used domestically. Total domestic sales amounted to about two-thirds of total sales from 1961 through 1965. By far the largest domestic market for dry whole milk is in the manufacture of candy and chocolate coatings, accounting for almost three-fourths of total domestic sales. Bakeries, baby food manufacturers, and institutions use most of the remaining dry whole milk. 2/ The market for dry whole milk has been restricted to ingredient uses in large part by the unsatisfactory flavor of reconstituted dry whole milk. During processing, the delicate flavor of fresh milk is usually lost. As a consequence, dry whole milk has been virtually unacceptable for beverage purposes in households or in institutional mass-feeding operations.

AN IMPROVED DRY WHOLE MILK

For many years, the dairy industry has sought a dry whole milk that compares with fresh milk in beverage quality, has a long shelf life, and reconstitutes easily. USDA researchers have been working on the problem and have developed a new spray-drying technique which yields a greatly improved milk powder. The process, called foam spray-drying, involves a slight modification of conventional spray-drying equipment so that nitrogen gas can be injected into the drier-feed just before spraying the milk. 3/ Injection of gas during the drying process results in an expanded powder particle which facilitates both drying and reconstitution. More important, the whole milk powder has an excellent initial flavor. When properly packed and kept under refrigeration, the powder retains a good flavor for about 6 months. 4/

1/ Estimated from wholesale prices and production figures reported in Supplement for 1963-64 to "Dairy Statistics," Statis. Bul. 303, U.S. Dept. Agr. pp. 60 and 117, tables 198 and 286.

2/ "1965 Census of Dry Milk Distribution and Production Trends," The American Dry Milk Institute, Inc.

3/ "Production and Properties of Spray-Dried Whole Milk Foam," F. P. Hanrahan, A. Tamsma, K. K. Fox, and M. J. Pallansch, Dairy Prod. Lab., U.S. Dept. Agr. Reprinted from Jour. Dairy Sci., Jan. 1962.

4/ Another team of USDA scientists has developed a vacuum foam-dried whole milk. Powder from this process is said to be equal in flavor to foam spray-dried milk with improved dispersibility and little or no foam head buildup. However, the cost of vacuum foam-dried powder is expected to be higher than its spray-dried counterpart. Powder from this process was not available at the time this test was made. A retail store test of this product is scheduled for the fall of 1967.

Although foam spray-drying produces a good quality powder, the powder has two undesirable physical characteristics. At the present stage of development, the powder has a relatively low density and tends to float on the surface of the water. This makes stirring necessary to dissolve it in the water. In addition, gas trapped in the powder during the drying process causes formation of a foam on the surface of the reconstituted milk. Researchers believe they may be able to improve the powder by using carbon dioxide instead of nitrogen gas in the drying process and cooling the hot powder immediately after drying.

Several plants are currently using the foam spray-drying method to produce cottage cheese whey and skim milk and could produce dry whole milk on a large scale. However, efforts to develop a market for the whole milk powder have not kept pace with technical developments. The fact that the powder reconstitutes into a fresh-tasting product and can be produced on a large scale forms a basis for increasing the effort to find a market for the product.

INSTITUTIONAL MARKET ACCEPTANCE

An important phase in the development of a new or improved product is testing it in various segments of the market. The high cost of failure makes knowledge of a product's market potential, prior to its commercial introduction, a virtual necessity. The USDA development of foam spray-dried whole milk powder has reached the stage where testing in the marketplace is considered desirable. An initial phase of market evaluation of the product consisted of a small-scale product test in selected institutions in the Washington, D.C., metropolitan area.

The fact that the residents of an institution are usually not involved in the preparation of the food may favor the chances of success of dry whole milk in this market. Residents of institutions are usually not aware of the original form of the food being served. Any bias they might have toward particular food forms is avoided if they do not know that a substitution is being made. The food managers need only be concerned with the appearance and quality of the prepared foods and the reaction of the residents to it.

The primary objective of the product test was to evaluate the acceptability of foam spray-dried whole milk when reconstituted and served as a beverage in place of fresh whole milk. While flavor is considered the key factor in the likely success of the product, the test also was intended to evaluate other factors: how well the powder reconstituted, how it was handled in the kitchen, and reaction to the persistent foam head after reconstitution.

Present Milk Use and Handling Practices in Institutions

The institutional market represents many types of establishments, such as restaurants, schools, hospitals, homes for the aged, and prisons. In selling to this market, the seller must not only ascertain consumer acceptance of the product, but also how it fits into the overall operations and procedures of the food service. Therefore, prior to the test of foam spray-dried milk, information was collected on present milk use and handling practices in various types of institutions. This phase of the study revealed that the methods of purchasing and serving milk vary considerably among institutions.

Types of Packaging

Institutions usually purchase fluid milk in one or more of the following types of containers: (1) Bulk containers for use in milk dispensing machines, (2) individual cartons, such as half pints, and (3) half-gallon cartons. The container that is most satisfactory varies among and within the major categories of institutions. The major factors influencing the choice of container appear to be convenience, cost, and health regulations.

Convenience or ease of handling, particularly when milk is served as a beverage, appears to be the major reason for purchasing fluid milk in individual cartons and bulk containers. These two methods of purchasing fluid milk are most prevalent in restaurants, colleges and universities, hospitals, and schools. Even those institutions serving beverage milk in half-pint cartons often purchase milk in half-gallon cartons for use in food preparation.

Institutions that purchase milk exclusively in half-gallon cartons appear to place greater importance on the cost of the milk than on handling. In the majority of cases, these are nonprofit or charitable institutions such as homes for the aged, prisons and jails, convents, seminaries, and orphanages. Because of budget limitations that usually exist in these types of institutions, it is necessary to provide an adequate diet at the least cost. Most of these institutions indicated that half-gallon cartons were the most economical method of purchasing the quantity of milk used in their operation.

Handling Practices

Convenient and efficient methods of handling milk are necessary in institutions that use large quantities of it. Bulk milk dispensers and individual cartons offer the advantage of portion control, and are satisfactory for use on cafeteria lines. Hospitals often prefer half-pint cartons because the milk must be transferred on trays from the kitchen to the patient.

Milk in half-gallon cartons apparently requires more handling than individual cartons, but this does not create any great problems in institutions not using cafeteria style service or individual tray service. Most of the institutions using half-gallon cartons provide table service, that is, the food is brought to the dining room on carts and placed on the tables by waiters or waitresses. When milk is served for drinking, the glasses are either filled in the kitchen and brought out with the other food or the cartons of milk are merely opened and placed on the tables. Sometimes stainless steel pitchers are used instead of milk cartons.

Health Regulations

State and local milk ordinances and food service sanitation ordinances influence milk use and handling practices. Managers in the study, however, were not familiar with the specific language of the ordinances. Therefore, the local health departments were contacted to obtain information about the various ordinances pertaining to the handling of milk in food establishments.

Milk sanitation ordinances in the Washington, D.C., area, as well as in other parts of the country, are similar to the Grade A Pasteurized Milk Ordinance recom-

mended by the U.S. Public Health Service. 5/ Although the various local ordinances differ slightly in their language, they all indicate that fluid milk products shall be served in the individual containers in which they are received from the distributor, or from an approved bulk dispenser. In addition, the ordinances usually state that only Grade A pasteurized milk or milk products shall be sold to the final consumer.

Current practices relating to the enforcement of the ordinances appear to vary. Some health authorities differentiate between public eating places and private institutions. For example, ordinances of some municipalities appear to exempt private clubs and church-affiliated or educational organizations.

In addition to the Milk Ordinance, the U.S. Public Health Service has also recommended a model Food Service Sanitation Ordinance for adoption by States and municipalities. 6/ Its provisions apply to all establishments where food is served to the public, including private or nonprofit organizations. Of the health departments contacted in the Washington metropolitan area, only Virginia municipalities have adopted this ordinance.

The provisions of the Food Service Sanitation Ordinance pertaining to fluid milk products are similar to the provisions of the Milk Ordinance. However, the Food Service Sanitation Ordinance is more specific about dry milk and milk products. This ordinance states that dry milk and milk products may be reconstituted in an establishment if used for cooking only. According to a PHS official, there were two primary factors involved in including this requirement in the model ordinance. One factor is that Grade A dry milk was not available in any great quantity at the time the ordinance was written. Commercial dry milk that is not manufactured from Grade A raw milk sometimes contains heat-stable toxins that are not destroyed by pasteurization. The second factor is the problem of preventing contamination and adulteration when the milk is reconstituted in the food service establishment. If Grade A dry milk products become common, health officials believe that it would probably be necessary to establish criteria or requirements for using dry milk for purposes other than cooking.

Testing the Product

The institutions participating in the test were selected on the basis of current milk use and handling practices. It appeared that institutions using half-gallon cartons of milk would be able to use the foam spray-dried milk on a trial basis without making major changes in their food service. These institutions also seemed to have a considerable interest in a more economical milk product.

The institutions that participated in the product test included three homes for the aged, two county jails, one day care center, one private high school, and one seminary. The product tests are presented as a series of case studies. Therefore, no definite conclusions about the overall institutional market possibilities for the product can or should be drawn from the results.

5/ "Grade 'A' Pasteurized Milk Ordinance," 1965 Recommendations of the U.S. Public Health Service. U.S. Dept. Health, Education, and Welfare.

6/ "Food Service Sanitation Manual," 1962 Recommendations of the Public Health Service. U.S. Dept. of Health, Education, and Welfare.

Homes for the Aged

Three homes for aged people were included in the product test. The combined population of the homes was about 260 people, 65 years of age and over. All three homes regularly use fresh whole milk in their food operation. Annual expenditures for fresh whole milk account for around 10 percent of total food expenditures, and therefore, the amount of milk used and method of purchasing it have a significant impact on the food budget. In general, it is not desirable or possible to decrease the use of milk. The most practical way to reduce expenditures for milk is in the method of purchase. According to the food service managers, the most economical method of purchasing milk for their size of operations is in quart or half-gallon cartons. They all had considered other methods of buying milk, such as bulk dispenser units. However, they found that when the cost of leasing or buying the dispenser is added to the cost of the milk, bulk milk was actually more expensive than half-gallon cartons of milk.

Milk was used for a variety of purposes in the homes, but approximately two-thirds was served as a beverage. The remaining one-third was used in about equal amounts for cooking and as an additive in coffee or on cereal. The objective of the test with dry whole milk was to determine its acceptability for all of these uses, and particularly as a beverage because of the proportion of fresh milk used for this purpose.

Each of the three homes was given a small quantity of the USDA foam spray-dried whole milk powder for trial use. The reconstituted milk was substituted for fresh milk in the food service. Residents of the homes were not informed that the product was going to be served, in order to eliminate any individual bias they might have toward dry milk. The trial use of the product was similar to the procedure followed in evaluating any new product that is added to the menu. Food managers listened for complaints or comments about the milk being served and observed the amount that wasn't consumed when it was served. In each home the manager or dietician was interviewed after the trial period to discuss the results, as well as other factors influencing the acceptability of the product.

The first step in the trial use of the milk powder was reconstituting the powder with tap water. Two of the homes used a floor model electric mixer equipped with a wire whip. With the electric mixer, the labor required to reconstitute the milk was minimal. None of the managers reported any difficulty in satisfactorily reconstituting the powder. One said that he even strained some of the reconstituted milk and was very surprised and pleased with how well the powder had dissolved. A thin layer of foam did persist on the surface of the reconstituted milk; all three managers decided to skim off the foam before serving the milk for drinking. The managers indicated, however, that they didn't consider the foam to be a serious problem, since it could be skimmed off.

After the milk was reconstituted, it was usually transferred to pitchers or glass bottles and stored in the refrigerator until mealtime. Thereafter, the reconstituted milk was handled in the same manner as fresh milk. It was served for drinking at least once in all three homes. At one home, the reconstituted milk was used exclusively for both cooking and drinking for one week. The other two homes used it periodically during a 1-week period.

The results of the trial use of the reconstituted whole milk were exceptionally good. The managers reported there were no unfavorable comments about the milk. Several residents did say that the milk was "richer." A dietician in one home

interpreted these comments as being favorable because many of the residents requested a second glass. However, the vast majority of the residents of the three homes did not react in any way to replacing the fresh whole milk with the reconstituted product. This indicated that the reconstituted milk was equal in quality to fresh milk and would be acceptable for use on a regular basis.

Following the trial use of the milk powder, the managers were asked if they would be interested in purchasing the product and using it regularly. All three said they would use it if the cost was around $0.05 less per quart than fresh milk. This $0.05 reduction in cost, in the opinion of two managers, would compensate them for any added preparation costs and allow them to reduce their expenditures for milk without reducing the quantity purchased. The third manager indicated that his home would probably purchase additional milk with the savings from using dry whole milk, thereby holding total milk expenditures constant. The residents of this home would like to have milk served at every meal. However, because of a very tight food budget, consumption of milk cannot be increased unless a cheaper source is found. At present, buying milk in half-gallon cartons is the least expensive method.

Jails

Two city jails were selected to participate in the test of the dry whole milk. The combined population of the jails was around 225 men, ranging in age from 18 to 60 years.

Both jails had been using a limited amount of fresh whole milk. Annual expenditures for fresh milk averaged about 3 to 4 percent of total food costs; this was considerably below expenditures by other institutions in the study. Consumption of fresh milk by inmates of the jails has been limited by its relatively high cost. Canned milk and nonfat dry milk had been used exclusively in both jails for many years, but complaints from inmates led to using fresh milk for drinking and on cereal. At the time of the survey, fresh milk was served three times per week for drinking in one jail, and twice per week in the other, for drinking and on cereal.

Powder that would make about 44 gallons of reconstituted whole milk was supplied free of charge to the jails for the test. No difficulty in reconstituting the milk was reported. An electric mixer equipped with a wire beater was used in one jail. To avoid lumping, the powder and about half the water were combined into a smooth paste and then the remaining water was added. The other jail did not have an electric mixer, so the milk was reconstituted manually in a metal pot. Only one problem was reported: Considerable foam appeared on the surface of the milk. When attempts to eliminate the foam by further stirring proved unsuccessful, it was skimmed off.

Just prior to the test, one of the jails had begun to serve fresh milk in half-pint cartons. The reconstituted milk could not be served in cartons, and the food manager thought the inmates would complain if glasses of the reconstituted milk were served in place of the cartons. Therefore, the reconstituted milk was served on two days when fresh milk was ordinarily not served.

Reaction to the product was mixed. Inmates working in the kitchen thought it was the best dry milk they had tasted. Opinions were not solicited from the inmates who were served in their cells, but the officer in charge believed some refused to drink the milk and poured it into the sinks in their cells. Based on

experience with new foods, particularly dehydrated foods, this was to be expected. The officer thought most inmates suspected that dry milk was being served and refused to drink it in an effort to discourage the permanent use of it in place of fresh milk. The food manager thought, however, that the flavor of the product was acceptable for drinking. Some of the reconstituted milk was used, with good results, in food preparation. Meat loaf appeared to hold together better when prepared with dried instead of canned milk, and scrambled eggs prepared with the test product were less watery than they had been.

In the other jail, the reconstituted milk was served twice in place of fresh milk--once in the evening for drinking and once at breakfast for use on cereal. The food service manager reported he received no unfavorable comments about the reconstituted milk and all of it was consumed by the inmates. The manager rated the reconstituted milk about equal to fresh milk in flavor and general acceptability.

At both jails, officers in charge of the food service concluded that the whole milk powder was acceptable for regular use. The major factor influencing their decision to use the product would be cost. Both managers indicated they would probably purchase the product if it was less expensive than fresh whole milk. One of them would use the savings to purchase larger quantities of milk, if possible increasing its use of milk from three times a week to once a day. The other manager thought his jail would use the powder, but he was not sure the quantity of milk used would be increased because milk in any form was considered relatively expensive. In addition, he thought the inmates were satisfied with the amount of milk they were currently using.

Theological Seminary

The seminary has an enrollment of around 200 postgraduate students ranging in age from 22 to 35 years. This test was different from the others in that the students were told about the dry milk when it was served.

The food service provides three meals a day for about 75 boarding students and lunch for everyone. All meals are served family style: the food is brought to the tables in bowls and on platters. Fresh milk is purchased in half-gallon cartons but is transferred to stainless-steel pitchers when it is served as a beverage. Pitchers of milk are usually placed on the tables for breakfast and lunch. This method of handling and serving milk was ideal for using the dry whole milk.

A food management company had complete responsibility for the food service, including the kind, amount, and form of foods to be purchased. The manager of the food service at the seminary was willing to try a small quantity of the dry whole milk, but indicated that the food management company would decide whether to purchase it. If the company decided to include a new product, like dry whole milk, in one of the food services it manages it would probably use the product in all of them. Therefore, the attitude of food management companies toward a new product could have a considerable influence on the institutional market for the product.

Reconstituted dry whole milk powder was served to 36 students at the seminary. The dietician said none of the students refused to drink the milk, and apparently liked it as well as fresh milk. Several students said the milk was "richer," but otherwise there were no comments about it. The dietician thought the product would be an acceptable replacement for fresh milk.

The dietician thought using dry milk on a regular basis might make compliance with the sanitation codes difficult; she thought it might be necessary to develop equipment that would reconstitute the milk and dispense it as needed. The local health department prefers that fluid milk be served in individual containers or from bulk containers equipped with an approved dispensing device. It will usually allow an institution to serve milk for drinking from half-gallon cartons, provided that when a carton is opened for use at a meal the milk from the carton is not used for beverage purposes at subsequent meals. However, any milk that is left over may be used in cooking.

Cost was another important factor to be considered, the dietician said. Based on her experience with nonfat dry milk, the dietician assumed that the dry whole milk would be less expensive than fresh milk. However, she had no idea what the company would consider a worthwhile saving. The company received a quantity discount on fresh milk which would have to be taken into account in any estimate of savings from using dry whole milk.

Private High School

This institution, an all-male boarding school operated by a church, has an enrollment of 225 students. Since all of the students reside at the school during the school year, a complete food service is necessary. The school, like the seminary, has a contract with a food management company.

Annual expenditures for fresh milk average about 20 percent of total food costs. Almost all of the students drink milk. It is served at two meals each day with no limit on the quantity that the students may drink.

While it is not unusual for a school to use large quantities of milk, nearly all public schools, and some private schools, are able to purchase milk at a reduced cost through the National School Lunch Program or Special Milk Program. These programs are usually given credit for increasing the consumption of milk in schools. However, many private schools, such as the boarding school where this study was made, do not participate in these programs. These schools might increase their consumption of whole milk if it could be purchased in a more economical form than fresh milk.

The usual procedure for testing new products at this school is to serve the product to a group of about 20 seniors who work as waiters. According to the dietician, their evaluation of the food strongly influences acceptance by the student body. If a new product is acceptable to the waiters, it rates a good chance of being accepted by the other students.

The reconstituted milk was served to the student waiters with the snack that they eat before serving the noon meal. Although they were not told about the test, most of them commented that there was something different about the milk. One student thought the milk was "old" and didn't drink an entire glass. Overall consumption, according to the dietician, was slightly less than normal. Although the students didn't like the test product as well as fresh milk, the majority told the dietician it was acceptable for drinking. The dietician said the powder would be a good product to stock for emergency use.

The ability of the students to distinguish the dry whole milk from fresh milk, whereas the residents of the other institutions apparently could not, suggests that

teenagers may have a keener sense of taste than adults. If so, the dry whole milk would probably not be as acceptable for use in high schools as in several of the other institutions where the product was tested.

Child Day Care Center

The center is operated by the city welfare department to provide low-cost day care for children from low income families, thus enabling mothers to work. Enrollment at the school consists of 36 children between the ages of 3 and 6.

The food service at the center provides a noon lunch and a morning and afternoon snack. The manager of the center indicated that she finds it difficult to operate the food service on the money budgeted. Only the most inexpensive foods are purchased. A major portion of the food budget, 37 percent, is spent for fresh whole milk, even though the amount of milk is limited to about two-thirds of a pint per child per day. In addition, a small amount of nonfat dry milk is purchased for use in cooking.

The dry whole milk powder was used for one week. The manager of the center expressed considerable interest in the product and was pleased to have an additional quantity of milk to serve the children. About 3 gallons of reconstituted milk was served each day. The powder was reconstituted manually in a metal cooking pot without difficulty, but a layer of foam appeared on the surface of the milk. The surface foam was skimmed off before the milk was served.

Since the teachers eat with the children at lunch time, they were able to observe the reaction of the children to the reconstituted milk when it was served. They reported that all the children drank it and the usual number asked for a second glass. There was one report of a few lumps in a glass of the milk in which the powder had not completely dissolved.

Since reconstituted milk as well as fresh milk was available, the children were given all they wanted. Consumption of milk increased by 50 percent during the trial period.

The manager rated the dry whole milk equal in quality to fresh milk and entirely acceptable for permanent use. The manager said she would use the whole dry milk if it was less expensive than fresh milk. The savings, she indicated, would be used to increase the consumption of milk. She thought the dry whole milk would be 5 to 8 cents less per quart than fresh milk.

PRICING OF DRY WHOLE MILK

The managers of the institutional food services surveyed were almost all of the opinion that dry whole milk would have to be less expensive than fresh milk before they would consider using it. Several managers thought the saving would have to be around 5 cents per quart.

Since foam spray-dried whole milk has not been introduced on the market, a selling price for it has not been established. The cost of manufacturing foam spray-dried whole milk has been estimated by engineers at USDA's Dairy Products Laboratory. 7/ Since the foam spray-drying process only involves a slight modifica-

7/ "Estimated Cost of Foam Spray-Dried Whole Milk," A. W. Farrall, F. P. Hanrahan, and R. L. Selman, Agr. Res. Serv., U.S. Dept. Agr. Speech presented before Amer. Soc. Agr. Engineers, Amherst, Mass., June 1966.

tion of conventional spray-drying equipment, the costs are expected to be very similar.

In view of the similarity in the costs of the foam spray-drying process and conventional spray-drying, it was decided to compare the selling price of dry whole milk that is on the market with the prices being paid for fresh milk. Several food wholesalers that supply the institutional market were contacted for price information on dry whole milk. Only three brands of dry whole milk were being stocked by the wholesalers surveyed. Because of the limited demand for the product, only one brand was stocked by each wholesaler.

Prices of the three brands of dry whole milk ranged from 60 to 76 cents per pound in the spring of 1966 (table 1). These were quoted prices before any volume discount or other type of discount.

Table 1.--Wholesale prices for dry whole milk, Washington, D.C., metropolitan area, spring 1966

Brand	Can size	Price per pound	Cost per half-gallon reconstituted 1/
	Pounds	Cents	Cents
A	1	64	32
	5	60	30
B	5	76	38
C	5	64	32
Average	--	66	33

1/ One pound of milk powder reconstitutes to 4 quarts of whole milk.

Data on prices being paid for fresh milk were collected from 6 of the 8 institutions participating in the product test. (The other 2 institutions would not disclose this information.) Prices paid for fresh milk ranged from 42.1 cents to 49.0 cents per half-gallon (table 2). The respondents reported that the prices they paid for milk were based to a great extent on the quantity used. Four of the six respondents reported that they received a discount from the list price (49 cents) based on the quantity purchased per week. The practice of giving quantity discounts on fresh milk might discourage the use of dry whole milk, particularly by large-volume users, unless similar discounts were available on the dry whole milk.

The reported prices for dry whole milk and fresh milk indicate that dry whole milk has a price advantage over fresh milk. The weighted average price paid for fresh milk in the six institutions is about 44 cents per half-gallon. By comparison, dry whole milk could be purchased at an average cost of 33 cents per half gallon (fresh equivalent basis). The difference amounts to 11 cents per half gallon. In view of the existing price differential, dry whole milk would make possible the 5-cent saving which the managers said they would require.

It has been assumed that foam spray-dried whole milk could be sold at a price somewhere around the average reported price for conventional spray-dried whole milk. In estimating the selling price for foam spray-dried whole milk, it is necessary to take into account any costs peculiar to beverage-quality whole milk powder.

Table 2.--Net prices paid for fluid whole milk and amount used by selected institutions, Washington, D.C., metropolitan area, spring 1966

Institutions	Price paid for fluid whole milk	Quantity used per week
	Cents per half gal.	One-half gal.
Home for the aged	42.1	375
Jail	43.8	60
Home for the aged	45.6	110
Jail	45.6	100
Home for the aged	49.0	38
Child day care center	49.0	30
Weighted average	43.9	--

At the present time, the foam spray-dried product will not maintain peak quality unless kept under refrigeration. Additional costs of refrigerated storage and transportation and perhaps packaging are expected to be partially offset by increased efficiency during the drying process. In addition, the foam spray-drying process appears to eliminate the need for "instantizing" the powder--improving its dispersibility in cold water--which has been estimated to cost around 1.5 cents per pound.

Prices Paid for Milk Used in Dry Whole Milk

The price advantage dry whole milk appears to have over fresh milk is due in part to the prices paid by the processor for the milk used in the two products. Under the classified pricing system for milk, milk producers are paid a higher price for milk used in fluid dairy products (Class I) than for milk used in manufactured dairy products (Class II).

Milk used in dry whole milk is presently assigned to Class II because it does not have to meet the same quality standards as milk for fluid consumption. At present, dry whole milk rarely competes with fluid products. However, with the commercial development of a beverage-quality dry whole milk, a change in the classification and pricing systems may be necessary. 8/

The U.S. Public Health Service has recommended a standard ordinance for dry milk products that carry a Grade A label. 9/ According to the ordinance, dry milk must be manufactured from Grade A milk in order to carry the Grade A label. In effect, this would probably mean that milk used in dry milk would have to come from the same source as milk for fluid consumption.

In order to obtain supplies of Grade A milk, processors of dry whole milk may eventually have to pay Class I prices, which would probably add to the selling

8/ "How the Federal Order Program Reacts to New Products," H.C. Forest, Sixth National Symposium on Dairy Market Development. American Dairy Assoc., Feb. 14-15, 1966.

9/ "Grade A Dry Milk Products," Supplement I to the Milk Ordinance and Code-1953. Public Health Service, U.S. Dept. Health, Education, and Welfare.

price of the dry milk and reduce the price advantage dry whole milk has over fresh fluid milk. The added cost can be estimated by calculating the difference in price of Class I and Class II milk.

Prices established for Class I and II milk in seven Federal milk marketing areas are shown in table 3. Since dry whole milk production is concentrated in Wisconsin, Michigan, and Minnesota, the difference in prices of Class I and II milk were compared for five marketing areas located in these States. The Washington, D.C., and Delaware Valley markets were included in the example to represent market areas where Class I prices are relatively high.

Table 3.--Prices established by Federal milk orders for Class I and II milk of 3.5 percent butterfat content, selected marketing areas, 1965

Marketing area	Class I	Class II	Differences between Class I and Class II	
	Dollars per 100 pounds		Dollars per 100 pounds	Cents per quart 1/
Northeastern Wisconsin	3.80	3.27	.53	1.14
Milwaukee	3.91	3.27	.64	1.38
Madison	3.91	3.27	.64	1.38
Southern Michigan	4.15	3.22	.93	2.00
Duluth-Superior	4.16	2.97	1.19	2.56
Washington, D.C.	5.43	3.26	2.17	4.67
Delaware Valley	5.85	3.32	2.53	5.44

1/ Calculated by dividing the dollar difference per 100 pounds by the quarts of milk per 100 pounds, or 46.5.

"Federal Milk Order Market Statistics." Annual Summary for 1965. Statistical Bulletin No. 374. Consumer and Marketing Service, U.S. Dept. of Agriculture, pp. 44 and 66, tables 20 and 30.

The difference in price between Class I and II milk ranged from 1.1 to 1.4 cents per quart in the three marketing areas located in Wisconsin. In the Minnesota and Michigan markets, Class I prices were 2.0 and 2.6 cents higher than Class II. Because of the relatively high price of Class I milk, the differences in price of Class I and II were 4.7 and 5.4 cents per quart in the Washington, D.C., and Delaware Valley markets.

Payment of Class I prices for milk would add to the cost of manufacturing dry whole milk. However, dry whole milk manufactured in market areas such as Wisconsin, where the difference between Class I and II is only 1 or 2 cents per quart, would still appear to have a price advantage over fresh milk in markets where Class I prices are relatively high.

At present, the eventual impact of the standard ordinance for Grade A dry milk on the price of dry whole milk is a matter of conjecture since the ordinance has not been generally adopted. However, there appears to be a growing need for Grade A dry milk products, which could eventually affect the cost and selling price of dry whole milk.

Cost Savings Associated with Dry Whole Milk

Dry whole milk appears to have two major cost advantages over fresh fluid milk: (1) Relatively low raw material costs in the areas of production, and (2) reduced distribution costs.

Savings from lower raw material costs are possible because the product can be manufactured in milk producing areas where fluid milk prices are relatively low. In general, fluid milk prices are lowest in areas of highest production, such as the Midwest, and increase as the distance from these areas increases. Dry whole milk manufactured in areas where fluid milk prices are relatively low would have a price advantage in markets where fluid milk prices are relatively high, so long as the differences in prices of fluid milk between markets are greater than the cost of shipping the milk powder.

Distribution costs for dry whole milk would apparently be considerably below those for fresh milk. The cost of delivering fresh milk to retail stores, for example, amounts to 7.5 cents per half gallon and is the largest component of the marketing cost for fresh milk. The cost of delivery consists primarily of wages paid to delivery employees and transportation costs. 10/

Since dry whole milk has a longer shelf life than fresh milk, it can be purchased in large quantities and stored till needed. The institutions in the survey receive deliveries of fresh milk three or more times per week. A reduction in the frequency of delivery would reduce distribution costs, as would the reduced weight and volume of dry whole milk. One pound of dry whole milk is equivalent to four quarts of fluid whole milk.

RESEARCH IMPLICATIONS

Foam spray-dried whole milk was rated acceptable for beverage use by the managers of all eight institutions. They were apparently satisfied with the dispersibility of the powder, but reported that foam formed on the surface of the reconstituted milk. The managers assumed that the residents would object to the foam and had the foam skimmed off before the milk was served. Scientists should seek to develop a product that is foam free.

Several institutions thought that to comply with health regulations they would need special equipment to reconstitute the powder and dispense the reconstituted milk. Future studies might seek to determine (1) what type of equipment is needed, and (2) the overall influence health regulations have on the present and potential use of dry milk for beverage purposes in institutional food services.

10/ "Cost Components of Farm-Retail Price Spreads for Foods," National Commission on Food Marketing. June 1966.

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